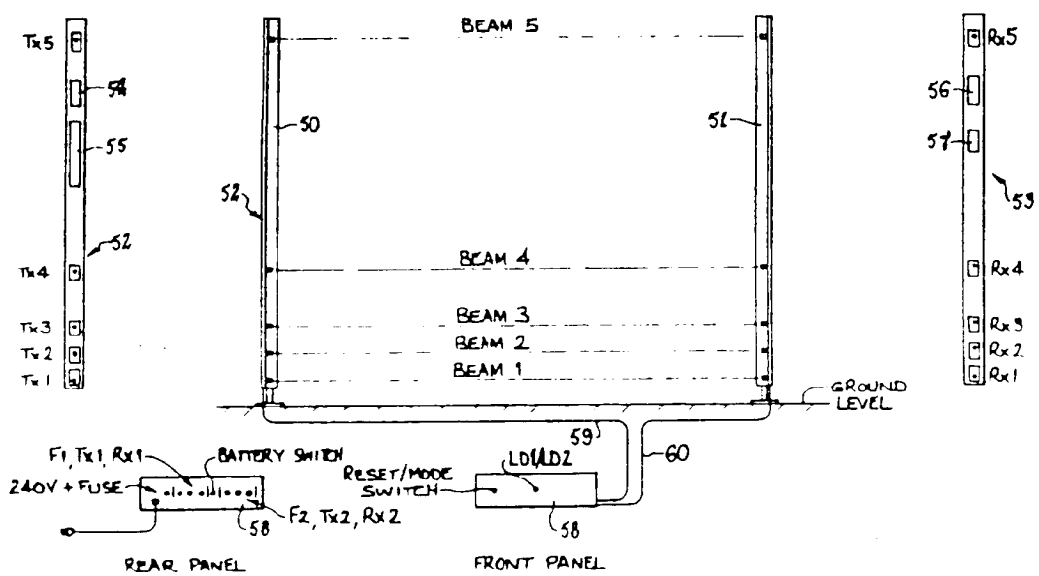




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(54) Title: DETECTION SYSTEM



... that an intruder passing into the protected area causes a break in at least one of the beams. The detection system includes means (Rx1-5) for receiving the electromagnetic (infrared) beams and for detecting breaks in the beams. The detection system also includes processing means (57) such as a microprocessor for receiving data associated with breaks in the beams. The processing means may initiate an alarm condition whenever the data associated with the breaks in the beams matches a predetermined beam signature i.e. a predetermined number or sequence of breaks in the beams. The microprocessor may be adapted to store a library of beam signatures for the purpose of identifying certain types of intruder. A swimming pool alarm incorporating the above detection system is also disclosed.

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DETECTION SYSTEM

The present invention relates to detection systems utilizing electromagnetic radiation. More specifically, this invention relates to a detection system capable of distinguishing between types of intruder passing into a protected area.

Electromagnetic radiation has previously been used for detecting the presence of intruders, whether moving or stationary. Many existing detecting devices incorporate an
10 alarm system which operates on the principle of intercepted electromagnetic radiation. However, a disadvantage of these systems is that they do not distinguish between types of intruder. Such alarm systems trigger regardless of the type of intruder.

The detection system of the present invention may have specific applications, for example detection of persons and other objects passing into a designated area such as a swimming pool.

Detection systems for swimming pools have been
20 available for some time. However, those presently available are designed to detect presence of children or pets after they have fallen into the pool. These systems operate on the principle of inertia detection which relies on a child or pet moving considerably in order for detection to take place. These devices are also subject to wear and corrosion, as by their very nature, they are required to float in the pool for long periods of time.

Pool fence systems are also available, however, these systems are often obtrusive both to the eye and to
30 the space surrounding the pool area. The present invention aims to provide a detection system which alleviates the disadvantages of the prior art.

be in communication with processing means. The processing
means may include a microprocessor or central processing
35 unit. The processing means may be adapted to identify

alarm conditions. An alarm condition may exist when an unwanted intruder passes into a designated area. Indication of an alarm condition may be by way of alarm means. The alarm means may include an audible sound generator or visual display.

10 The detection posts may include transmitting and/or receiving means. The transmitting means may comprise one or more transmitting units. The receiving means may comprise one or more receiving units. The, or each transmitting unit may be adapted to transmit an electromagnetic beam. The, or each receiving unit may be adapted to receive an electromagnetic beam. The, or each electromagnetic beam may comprise infrared radiation. Each transmitting unit may comprise an infrared diode transmitter. Each receiving unit may comprise a photo-detector or similar receiver.

20 The detection posts may be of any convenient dimensions. Each post may have a height between 1 meter and 2.5 meters. Each post may be adapted to be placed in an upright position. This may be by means of a stand or alternatively the post may be permanently fixed in the ground or surface of the designated area. One preferred arrangement of the posts may be such that a person or object intruding into an area to be protected is intercepted by at least one of the beams.

In a preferred embodiment of this invention, a system may be arranged such that all entrances to a designated area such as a swimming pool area, are guarded by electromagnetic beams.

30 One preferred system may comprise an arrangement including at least two detection posts. In a two post system, one detection post may include primarily receiving means. Such a post will herein be referred to as a primary post. The primary post may be adapted to house the receiving units. The other detection post may include primarily transmitting means. The latter post will be herein referred to as a secondary post. The secondary post
38 may be adapted to house the transmitting units. In such an

arrangement, each transmitting unit may transmit an electromagnetic beam from the secondary post to a corresponding receiving unit of the primary post.

The placement of each receiving unit relative to its corresponding transmitting unit may be such that each receiving unit receives an electromagnetic beam transmitted by a corresponding transmitting unit. The number of beams is not critical, but a number greater than two is preferred.

10 It is also possible for the secondary post to act as a reflective post, to reflect transmitted beams back to the primary post. In this situation it will be preferable that the primary post contains both transmitting and receiving means.

In one particular preferred embodiment, the system may comprise transmitting units for transmitting five separate electromagnetic beams. The transmitting units may be arranged such that the five beams lie in a substantially vertical arrangement. The arrangement may be such that three transmitting units occupy lower most positions on the
20 post. These lower most units are herein referred to as lower units. The lower units are preferably spaced at approximately equal intervals. Each interval may be between 5 cm to 20 cm. The arrangement may be such that the upper most of the lower units is preferably no more than 60 cm from the ground or surface when the post has been installed. A fourth unit may be located approximately mid way along the post. The fourth unit will herein be referred to as a middle unit. The middle unit may be located between 30 cm and 70 cm from the ground or
30 surface. A fifth unit, may be located in an upper most position on the post. The fifth unit will herein be referred to as an upper unit. The upper unit may be located in the vicinity of the top of the post, and such that it lies preferably between 100 and 250 cm from the

Electromagnetic beams, each beam may be modulated by
38 modulating system. Each beam may be modulated such that it

is encoded with a distinct frequency. The modulating system may include modulating means associated with each transmitting unit.

Each receiving unit on the primary post may be associated with a corresponding de-modulating means such that each receiving unit recognises only its corresponding transmitting unit.

10 If the electromagnetic beams are provided via a coherent source such as a laser, scattering would be minimised. In such situations, modulation of the electromagnetic beams may be dispensed with.

Cross talk may alternatively be suppressed via a multiplex system. The multiplex system may include multiplex means associated with the transmitting units. Corresponding de-multiplex means may be associated with the receiving units. A multiplex system may be used in addition to or in place of a modulating system.

20 It will be appreciated that when electromagnetic beams arranged vertically are intercepted by a person or object having a predetermined size and/or shape, one or more beams will be intercepted in a given sequence or sequences. Such a pattern of interceptions may be associated with the person or object which produced the pattern.

Different persons or objects will produce different patterns or "beam signatures". Such beam signatures may be used to identify the persons or objects which produced the patterns. Once a "library" of beam signatures has been established for a variety of persons or objects, such
30 signatures may be used to identify the persons or objects which produced the signatures. Such a library of beam signatures may be stored in the processing means for identification purposes.

The processing means of the present invention may receive information from one or more receiving units. The processing means may be adapted to recognise beam signatures and hence to identify the objects which produced
38 the beam signatures. The processing means may be adapted

to trigger an alarm condition whenever a predetermined beam signature is received.

The processing means may include one or more logic units. The, or each logic unit may be user programmable or it may comprise hard wired logic such as a diode logic array. The processing means of the present invention may include a control unit. The control unit may be integrated with the processing means or it may be remote therefrom.

10 The receiving units in the primary post preferably are in communication with a logic unit. This logic unit may be contained in the primary post itself. It is preferable that this logic unit is a programmable logic unit and that it is programmed to recognise beam signatures received by the receiving units. An alarm condition preferably exists whenever an intruder intercepts a predetermined number of electromagnetic beams.

20 In order to provide protection in a specific application, namely a swimming pool detection system, a variety of predetermined beam signature modes may be programmed into the logic unit.

A first mode may be referred to as an active mode. In the active mode, all beams preferably are operating. In one form if any two of the four beams transmitted from the lower units and the middle unit are broken simultaneously, this beam signature may be recognised as an alarm condition. Any breaks in the beams exceeding approximately 40 milliseconds may be registered for evaluation. The system may be programmed so as to disregard breaks under a duration of approximately 40 milliseconds. However, this
30 time duration may be variable depending upon the application of the system.

In another form, if any two of the lower four beams are broken simultaneously for a period of 40 milliseconds, the system may assume alert mode and after 3 seconds may

38 reset condition in 3 seconds and after 3 seconds return to mode. In the reset condition, breaks in the lower beams

may be ignored. Reset condition may also be initiated via the control unit.

In the active mode it is preferable that a break of the beam transmitted from the upper unit simultaneously with a break of the beams from the lower and middle units does not constitute an alarm condition. An alarm condition also preferably does not apply if the beam from the upper unit is broken within approximately 30 seconds of the breaking of the beams from the lower and middle units. In one preferred form, alarm conditions may not apply when the beam from the upper unit is broken up to 3 seconds before or up to 10 seconds after the breaking of the beams from the lower and middle units, as this may improve the safety factor of the system. In the active mode the breaking of the beam from the upper unit may indicate presence of an adult in the region.

A second mode for this system may be referred to as a sleep mode. In the sleep mode, an alarm condition may be recognised when the beam from the middle unit and any one of the beams from the lower units are broken. In the sleep mode, if the beam from the middle unit is broken, an intruder is likely to be at least 60 cm in height. It is thus possible to distinguish small objects such as cats or possums, which may break only the beams from the lower units, from a child that is capable of breaking the beam from the middle unit also.

A third mode may be known as an override mode. In the override mode, the system may be programmed such that the active mode may be operative if the beam from the upper unit has not been broken for period of preferably up to about 60 minutes. Periods of longer time are within the scope of the invention depending upon the application of the system. To improve safety, it is preferable that this period be set at about 20 minutes. In the override mode, supervision of an adult may be recognised without the requirement that the adult be passing through the beam constantly.

A fourth mode may be known as a party mode. In the party mode lower beam breaks may be ignored for a period of 3 minutes. After this time the system may revert to active mode. If however the upper beam is broken during this time the system may reset to party mode and restart a three minute timer. Party mode may be initiated from the control unit. The control unit may be adapted to select one or more of the operating modes previously described. In one form the control unit may be adapted to program the processing means to recognise preferred beam signatures.

To minimise risk of false alarms, the width of the beams may be relatively large. The width of the beams preferably are no greater than the width of a child's leg. It is also preferable that the beam width is greater than common objects which may pass through the beam such as the ankle of a cat or a dog. The preferable means for registering a break of the beam is such that the break may only be recognised if the entire width of the beam is blocked or broken. This is preferred as it may enable the beam to distinguish the width of a child's leg which may block a beam entirely, from smaller objects which may pass through the beam without blocking the beam entirely.

Optionally the upper, middle and lower beams may have different widths. For example, the beam from the upper unit may be slightly wider than the beams from the lower units. This may assist distinguishing the upper portion of a human torso which is wider generally than that of a child's leg. It may also assist in distinguishing relatively narrow objects which may pass through the upper beam carried by a child, such as a stick or a broom handle.

It is to be understood that these are only preferred beam signatures which may be recognised, and that other beam signatures may be programmed into the system.

The number of posts is not limited within the scope

of the invention. In another preferred system

the system may be adapted to recognise other preferred signatures.

A four post system, may include a primary post and a secondary post. The primary and secondary post preferably perform receiving and transmitting functions respectively. A four post system may include a pair of slave posts. The slave posts may perform both transmitting and receiving functions.

10 The posts in a four post system may be arranged in a designated area in any convenient manner. Preferably the posts are arranged such that lines drawn between adjacent posts define a quadrilateral.

Presence of an intruder may be determined by detecting a break in beams transmitted between any two adjacent posts. Such "break" data may be transferred back to the primary post in any convenient manner. In one form break data may be transferred by suitably modulating beams linking the four posts. Alternatively this transfer may be via land lines or other suitable communication means.

20 In a preferred example, wherein five levels at which the beams may be transmitted are provided, each level on the posts preferably comprises a pair of transmitting and/or receiving units in each post. The transmitting and receiving units may be placed relative to the posts such that each receiving unit receives an electromagnetic beam transmitted from a corresponding transmitting unit on an adjacent post.

30 A secondary post of this system may include a pair of transmitting units at each level. One transmitting unit of each pair may be directed to transmit to the primary post while the other transmitting unit may be directed to transmit to a slave post. Alternatively both transmitting units may be directed to transmit to respective adjacent slave posts.

38 One slave post (referred to as the first slave post) may receive beams from the secondary post. The first slave post preferably receives beams at all five levels. The first slave post may also transmit beams to the other slave post (referred to as a second slave post). Accordingly, the second slave post may include at least one receiving

unit adapted to receive at least one beam from the first slave post.

The first slave post preferably includes associated logic means. In one form each receiving unit in the first slave post may be in communication with the logic means. The logic means may be adapted to receive break data from the, or each receiving unit of the first slave post. The logic means preferably is adapted to recognise predetermined beam signatures. Output from the logic means may be transmitted to the second post via a modulated beam(s). The latter may be modulated in accordance with the output from the logic means.

The second slave post may also include associated logic means. The latter logic means may be adapted to receive break data from the, or each receiving unit of the second slave post. The logic means of the second slave post may be adapted to recognise break data received from the, or each receiving unit of the second slave post. The output from the logic means of the second slave post may be subsequently transmitted to the primary post via a modulated beam(s). The latter may be modulated in accordance with the output from the logic means of the second slave post.

The primary post may be adapted to recognise predetermined alarm conditions as described for a two post system.

A further preferred embodiment of the invention, may comprise reflective means in each of the posts other than the primary post. The primary post in this situation, may act as both a receiving and transmitting means. The reflective means may comprise mirrors and may be aligned in such a manner that the beam will be reflected around the perimeter of the designated area, returning to the primary post. A break or block to the beam pattern may be detected

reflective means. Means other than posts may be incorporated as means to house the reflective means. The

reflective means may not be situated at any distinct level, but should be such that the electromagnetic beams being transmitted are maintained at distinct levels.

The detection posts may be powered by an A.C. or D.C. source.

According to the present invention there is provided a detection system for detecting an intruder passing into a designated area, said system comprising:

10 transmitting means for transmitting a plurality of electromagnetic beams, said beams being arranged such that said intruder passing into said area may cause a break in at least one of said beams,

receiving means for receiving said beams and for detecting the or each break in said beams,

processing means for processing data associated with the or each break in said beams and for initiating an alarm condition whenever said data corresponds to a predetermined number or sequence of breaks in said beams.

20 Preferred embodiments of the present invention will now be described with reference to the accompanying drawings wherein:

Figure 1 shows a block diagram for a two post system incorporating a multiplex facility;

Figure 2 shows a block diagram for a two post system incorporating a modulating facility;

Figure 3 shows a block diagram for a four post system incorporating a modulating facility;

Figure 4 shows an external view of one form of post for a four post system;

30 Figure 5 shows one arrangement for a pool alarm system incorporating the principles of the present invention;

Figure 6 shows a schematic diagram of the control unit;

Figure 7 shows a schematic diagram of the transmitter circuit board; and

38 Figure 8 shows a schematic diagram of the receiver circuit board.

In figure 1 of the drawings a five beam multiplex system is shown. Each transmitting unit designated Tx1 to Tx5 is incorporated in a secondary post. Each transmitting unit is connected to a multiplex unit MUX as shown. Each transmitting unit has a corresponding receiving unit designated Rx1 to Rx5 incorporated in a primary post. Each receiving unit is connected to a corresponding de-multiplex unit DE-MUX. The de-multiplex unit feeds data from the receiving units to a central processing unit (CPU). The CPU is a preferred processing means. A control unit is incorporated to program the central processing unit, to a selected mode. The CPU is adapted to recognise alarm conditions depending upon the selected mode. An alarm means is triggered by the CPU upon recognition of an alarm condition.

In figure 2 of the drawings, Tx1 to Tx5 designate the transmitting units of a secondary post. Individual modulating units M1 to M5 are associated with corresponding transmitting units Tx1 to Tx5. Corresponding receiving units Rx1 to Rx5 are arranged on a primary post. De-modulating units DM1 to DM5 are associated with corresponding receiving units Rx1 to Rx5. De-modulating units DM1 to DM5 feed data from the receiving units to a central processing unit (CPU). The CPU can be programmed by a control unit to recognise predetermined alarm conditions. An alarm means is triggered by the CPU upon recognition of an alarm condition.

In figure 3 of the drawings, a five beam four post system is shown. This system is a modulated system with transmitting units Tx1 to Tx20 having associated modulating units M1 to M20. Each receiving unit Rx1 to Rx20 has an associated de-modulating unit DM1 to DM20. In this system the secondary post transmits directly to the primary post through transmitting units Tx2, 4, 6, 8 and 10 and to the

post, break data received by receiving units Rx1, 3, 5, 7

and 9 is transferred to logic unit A. Logic unit A modulates transmitting unit Tx11 via modulating unit M11. Modulating unit M11 modulates the transmitted beam in accordance with break data received from logic unit A. Break data may be carried by one transmitting unit or it may be carried by two or more transmitting units from the first slave post.

10 The second slave post receives modulated beams from the first slave post via receiving units Rx11, 14, 16, 18 and 20. Break data received by these receiving units is transferred to logic unit B and transmitted to the primary post via transmitting unit Tx12. This beam is modulated with break data by modulating unit M12. Transmitting units Tx12, 13, 15, 17 and 19 all transmit to the primary post, with break data being carried by the transmitted beam of Tx12.

20 All receivers on the primary post are connected to a central processing unit (CPU). The CPU can be programmed by a control unit to recognise predetermined beam signatures as alarm conditions. An alarm is triggered upon recognition of an alarm condition.

30 Figure 4 of the drawings shows one form of detection post. Means 1 is adapted to house the receiving and/or transmitting units. The latter means may be such that the receiving and/or transmitting units are arranged substantially normal to each other to transmit or receive to or from adjacent posts. The relative heights of the transmitting or receiving units in relation to each other are shown with the lower units occupying the housing means 2, the middle unit occupying the housing means 3, and the upper unit occupying the housing means 4. The detection post can be adapted to stand substantially upright on a base 5.

37 The pool alarm system of figure 5 includes a transmitting post 50 fixed at ground level in the vicinity of a pool. A receiving post 51 is fixed some distance from transmitting post 50 to define a detection zone.

Post 50 retains a transmitter circuit board 52 and post 51 retains a receiver circuit board 53. Circuit board 52 includes transmitting units Tx1 to Tx5, a voltage regulator module 54 and logic module 55. Circuit board 53 includes receiving units Rx1 to Rx5, voltage regulator module 56 and microprocessor 57.

Lower transmitting units Tx1 to Tx3 are spaced approximately 100 millimeters apart as shown and lower most unit Tx1 is spaced approximately 100 millimeters above ground level. Middle transmitting unit Tx4 is spaced approx. 200mm above lower unit Tx3 and upper transmitting unit Tx5 is spaced approximately 850 millimeters above middle unit Tx4.

Each post 50, 51 comprises a hollow aluminium extrusion approximately 1450 millimeters in length. Posts 50, 51 are connected to a remote control unit 58 via cables 59, 60 respectively. Control unit 58 may be placed in the home or a similarly convenient location.

Figure 6 shows a circuit diagram of the control unit 58. The control unit of figure 6 includes a mains operated D.C. power supply shown generally at 61. Power supply 61 includes a mains transformer TR1 the output of which is filtered, rectified and regulated to provide power for transmitting post 50 and receiving post 51.

The power supply is provided with battery back-up in case of power failure. The battery is trickle charged by the power supply.

Power and control signals are interfaced between control unit 58 and posts 50, 51 via connectors on a rear panel. Control unit 58 has provision for operating two systems. Mains operation is indicated by LD1. Battery operation is sensed by T1 and indicated by LD2.

Control unit 58 includes an alarm and mode selection circuit shown generally at 62. Battery low volts is sensed

different sounding alarm SW1. Battery mode and reset SW2 is selected via switches SW2 and SW3 on the front panel.

Figure 7 shows a circuit diagram of the transmitter circuit board 52 including logic module 55 and transmitting unit Tx1 (transmitting units Tx1 to Tx5 are identical). Figure 7 also shows a circuit diagram of the voltage regulator module 54.

Power to regulator module 54 is provided via two wires from the control unit 58. LD1 of regulator module 54 indicates power and code transmission is indicated by LD2 of logic module 55.

10 Timing in logic module 55 is provided by IC1 and multiplexing of the beams by IC2. Each of the five transmitting units Tx1-5 is presented with its own unique coded PPM (Pulse Position Modulation) signal from remote control transmitter IC7, in conjunction with a series of bilateral switches, IC5 and IC6. The combination of AND gates IC3, IC4 and IC8, ensures that correct codes are sent to the appropriate transmitting units via buffers IC9. Pulse Position Modulation was chosen after some initial
20 testing because of the need to identify each individual beam by the receiving units and for its "off the shelf" availability.

Transmitting power can be set High or Low via a strapping arrangement. Two high power GaAlAs (Gallium Aluminium Arsenide) Plastic Infrared Emitting Diodes, operating at a wavelength of 875nm, are driven from the logic module 55 via T1 and Darlington Pair T2.

30 Figure 8 shows a circuit diagram of the receiver circuit board 53 including microprocessor 57, receiving units Rx1/Rx5 (receiving units Rx1 to Rx5 are similar) and voltage regulator module 56 comprising regulators 56a and 56b.

Power and control signal connections between the control unit 58 and the receiving post 51 is via a five conductor cable, two wires for power, two for reset and party mode signals from the control unit 58 and one to enable the alarm in the control unit.

38 Four status LEDs are provided for indicating power, reset, beam break and party mode.

Microprocessor 57 comprises an 8-Bit EPROM type 68705 with on-board clock, RAM, I/O, and timer. Microprocessor 57 controls all functions of the receiving post 51 and is powered by a 7805, 5 volt regulator as shown at 56b.

Power for the receiving units Rx1 to Rx5 is obtained from the voltage doubler and 16 volt regulator 56a, which is required to allow operation from a 12 volt battery backup.

10 The five receiving units Rx1 to Rx5 are each divided into two halves, an infrared pre amp 80 and a remote control receiver 81. Remote control receivers of receiving units Rx1 to Rx4 use RS927's, which receive only codes beginning with a "1". The remote control receiver of receiving unit Rx5 uses an RS926 which only receives codes beginning with an "0", ensuring 100% security of the upper beam.

20 The RS486 of pre amp 80 receives PPM signals via infrared photo-diode IR. The associated circuitry allows the pre amp 80 to present, stable PPM signals to receiver 81 for decoding. The decoded D.C. output is then fed into microprocessor 57.

The system shown in figures 5 to 8 has a number of features which enables continued operation or alarm indication in case of a malfunction. These include:

- (a) Alarm mode is assumed if upper beam 5 is not received for a period of 2 minutes;
- (b) If any one of the lower beams 1-4 malfunctions the system remains active, however in this situation only one
30 more of the lower beams is required to be broken to initiate an alarm condition. Similarly if two or more of the lower beams fail, alarm mode is assumed.
- (c) Any beam break must be greater than 40 milliseconds duration before it is registered as a break. This

(d) The alarm times out after a period of 10 minutes with legislation in some countries.

38

It will be appreciated that various alterations, modifications and/or additions may be introduced into the constructions and arrangements of parts previously described without departing from the spirit or ambit of the present invention.

5

The claims defining the invention are as follows:

1. A detection system for detecting an intruder passing into a designated area, said system comprising:
transmitting means for transmitting a plurality of electromagnetic beams, said beams being arranged such that said intruder passing into said area may cause a break in at least one of said beams,
receiving means for receiving said beams and for detecting the or each break in said beams,
10 processing means for processing data associated with the or each break in said beams and for initiating an alarm condition whenever said data corresponds to a predetermined number or sequence of breaks in said beams.
2. A detection system according to claim 1 wherein said transmitting means comprises a plurality of transmitting units.
3. A detection system according to claim 2 wherein each transmitting unit comprises an infrared diode transmitter.
4. A detection system according to claim 1, 2 or 3
20 wherein said receiving means comprises a plurality of receiving units.
5. A detection system according to claim 4 wherein each receiving unit comprises an infrared photo-diode.
6. A detection system according to any one of the preceding claims wherein said transmitting means includes means for multiplexing said beams.
7. A detection system according to claim 6 wherein said receiving means includes means for de-multiplexing said beams.
- 30 8. A detection system according to any one of the preceding claims wherein said processing means comprises an EPROM microprocessor.
9. A detection system according to any one of the preceding claims wherein said processing means is adapted
processing means includes a control unit for selecting said
operating mode.

11. A detection system according to claim 10 wherein said control unit is adapted to select active mode, sleep mode, override mode or party mode.
12. A detection system according to any one of the preceding claims including alarm means, said alarm means being actuated by said processing means upon initiation of said alarm condition.
13. A detection system according to any one of the preceding claims wherein said transmitting means is associated with a transmitting post and said receiving means is associated with a receiving post.
14. A detection system according to claim 13 further including at least one slave post.
15. A detection system according to claim 14 wherein said at least one slave post is adapted to relay data to said receiving post.
16. A detection system according to claim 1 substantially as herein described with reference to figure 1 or 2, or 3 or 4 or figures 5-8 of the accompanying drawings.
17. A pool alarm incorporating a detection system according to any one of the preceding claims.

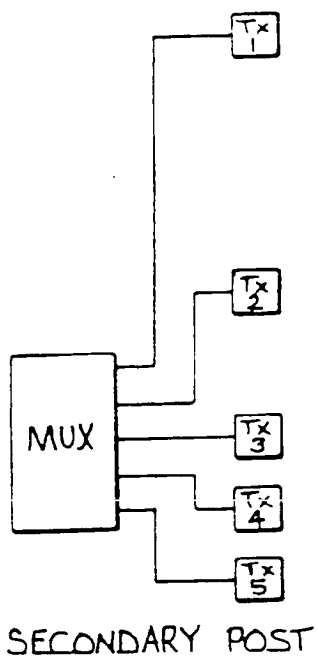


FIG 1

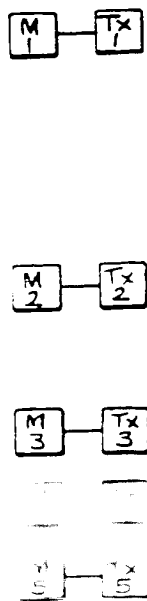
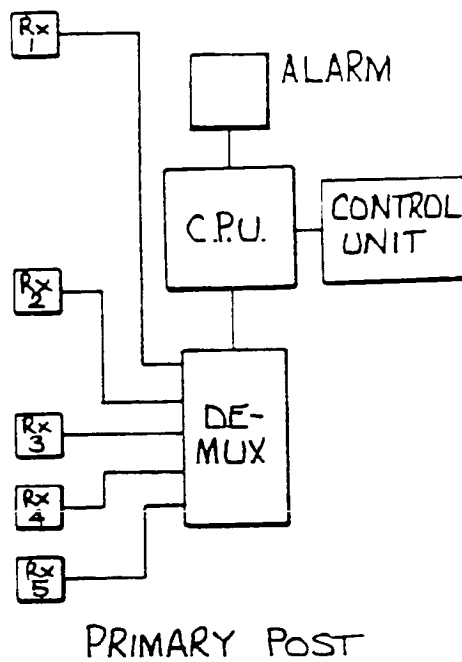
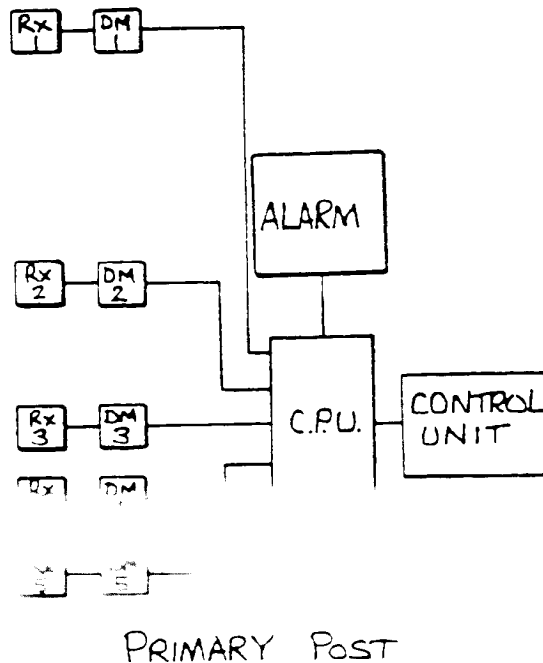
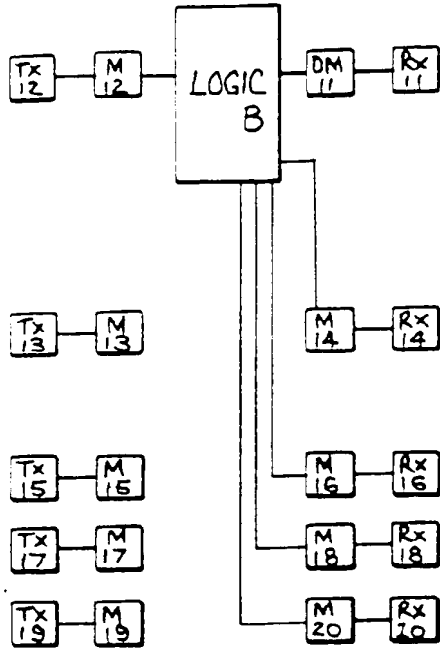
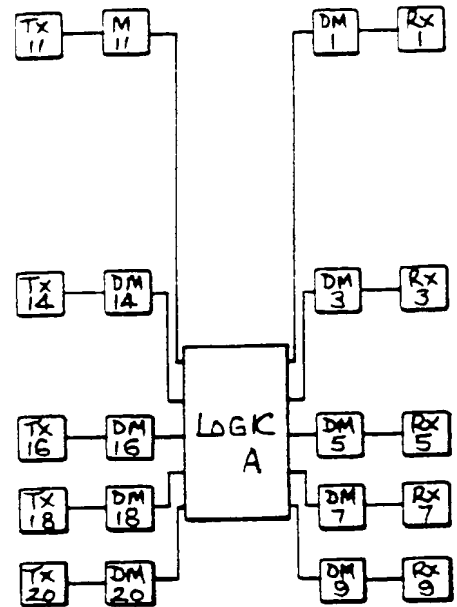


FIG 2

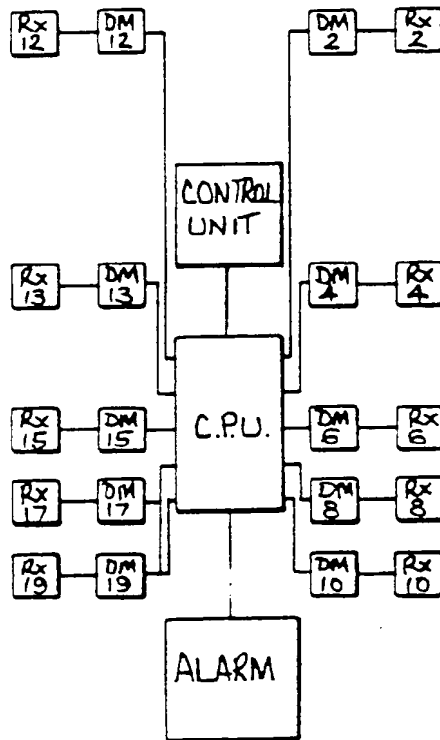




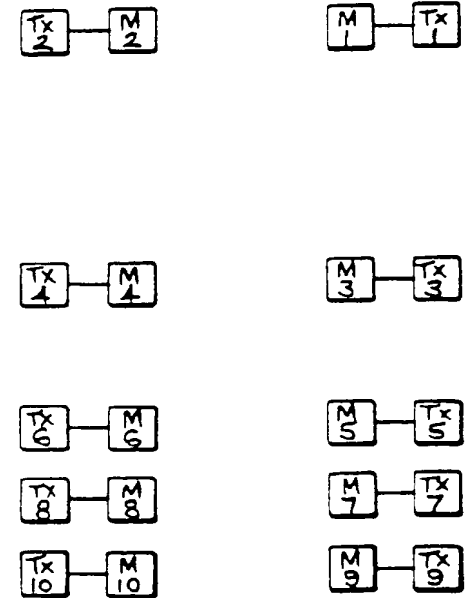
SECOND SLAVE POST



FIRST SLAVE POST

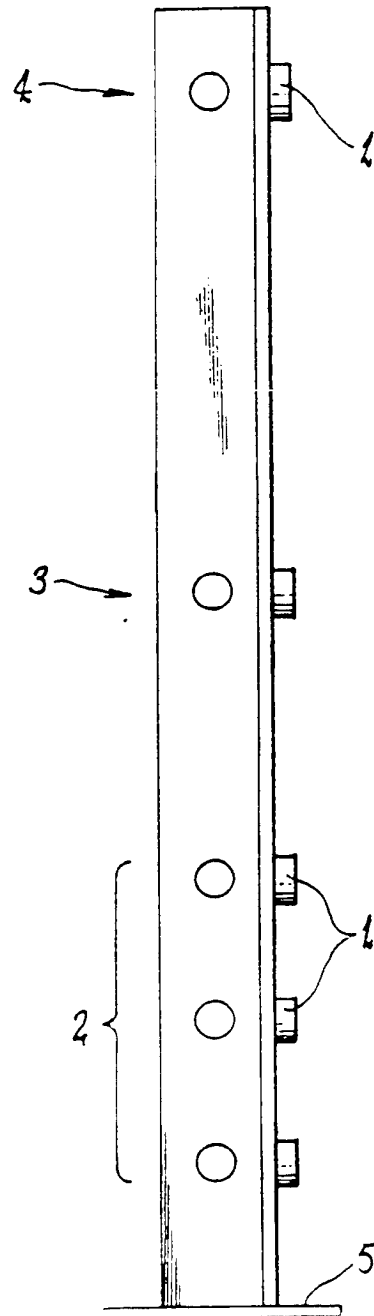


PRIMARY POST



SECONDARY POST

FIG 3



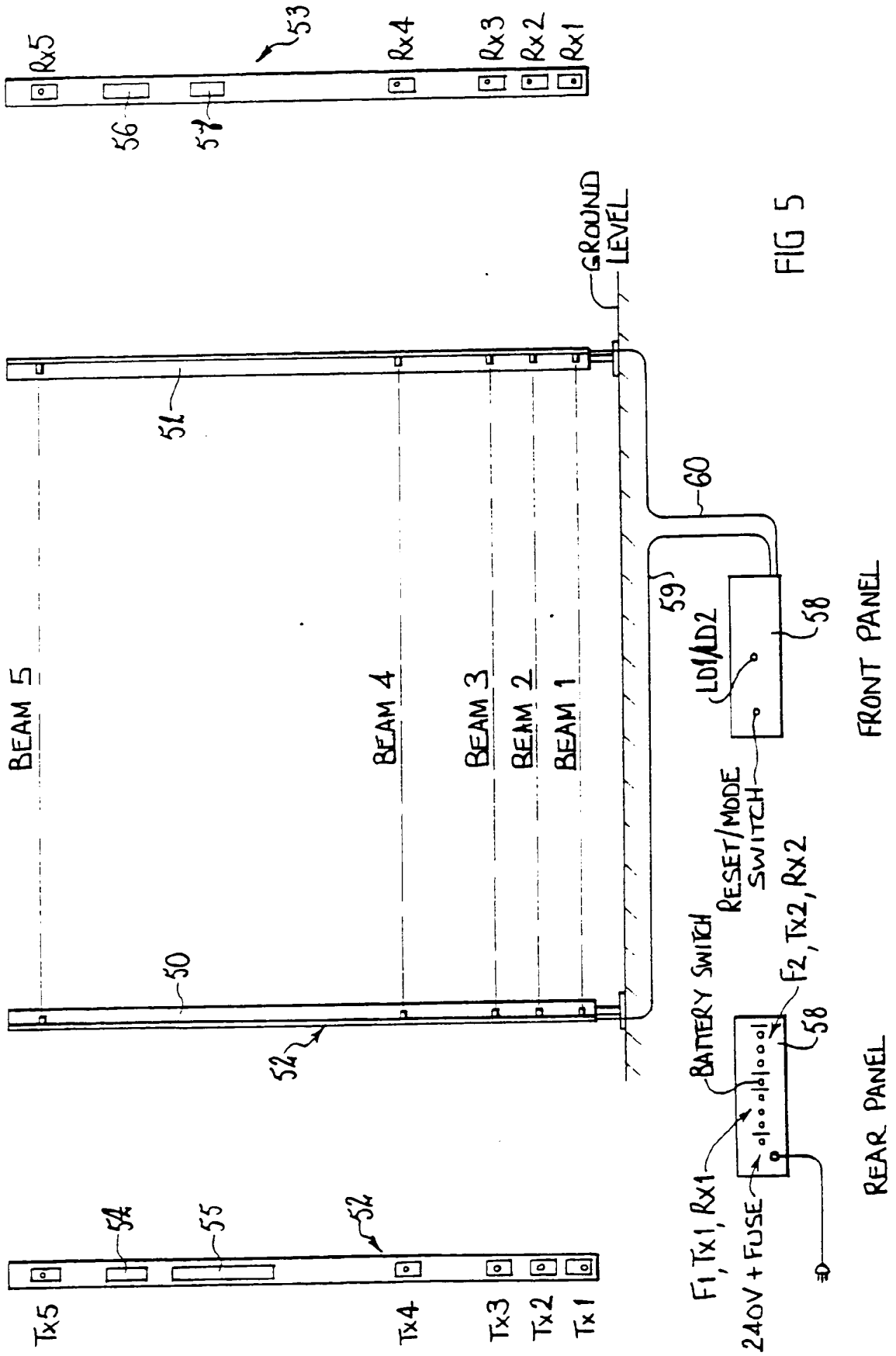


FIG 5

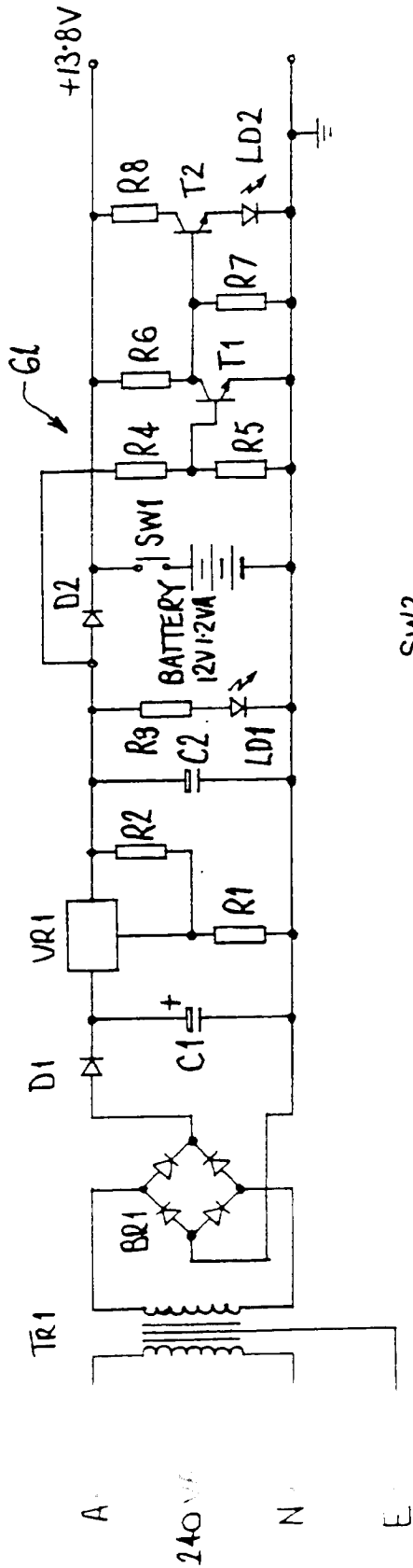
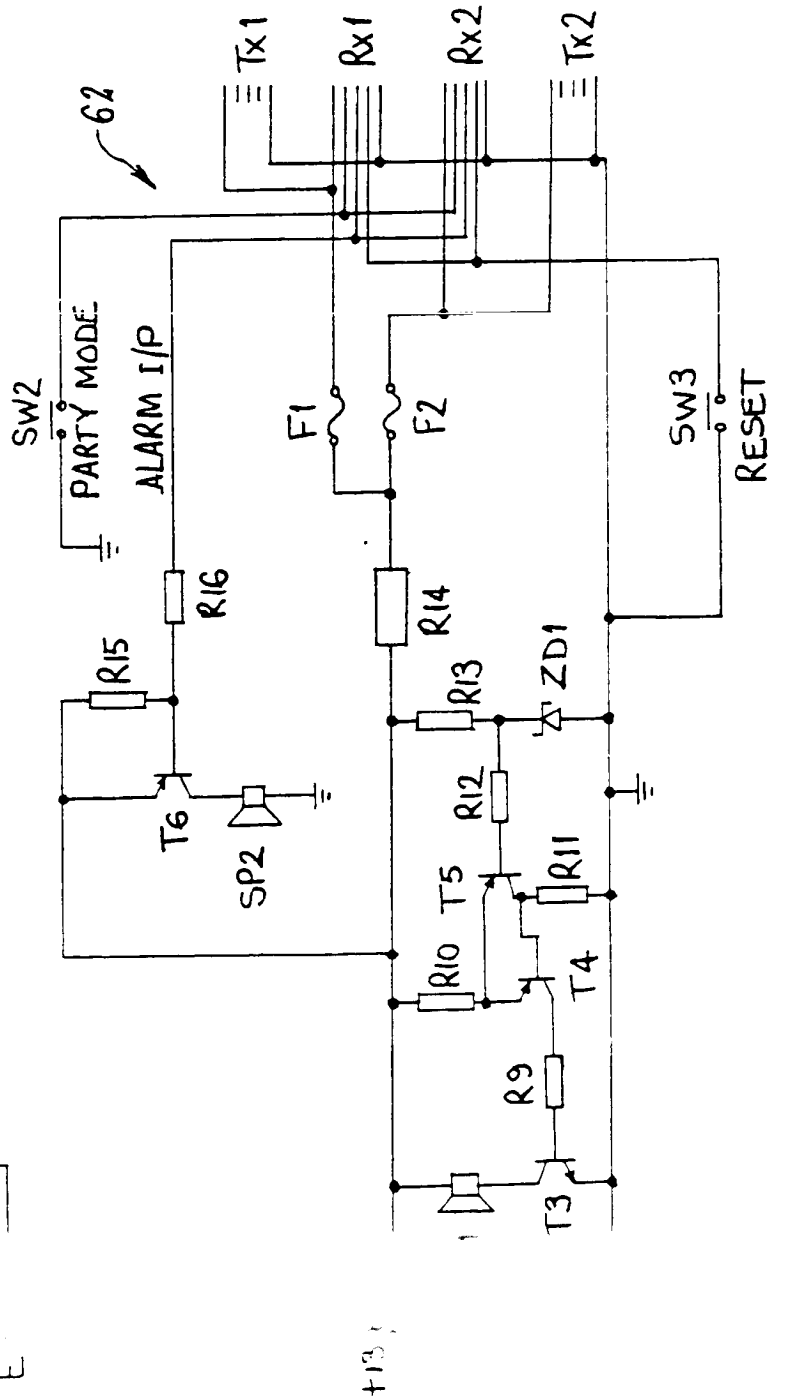


FIG 6



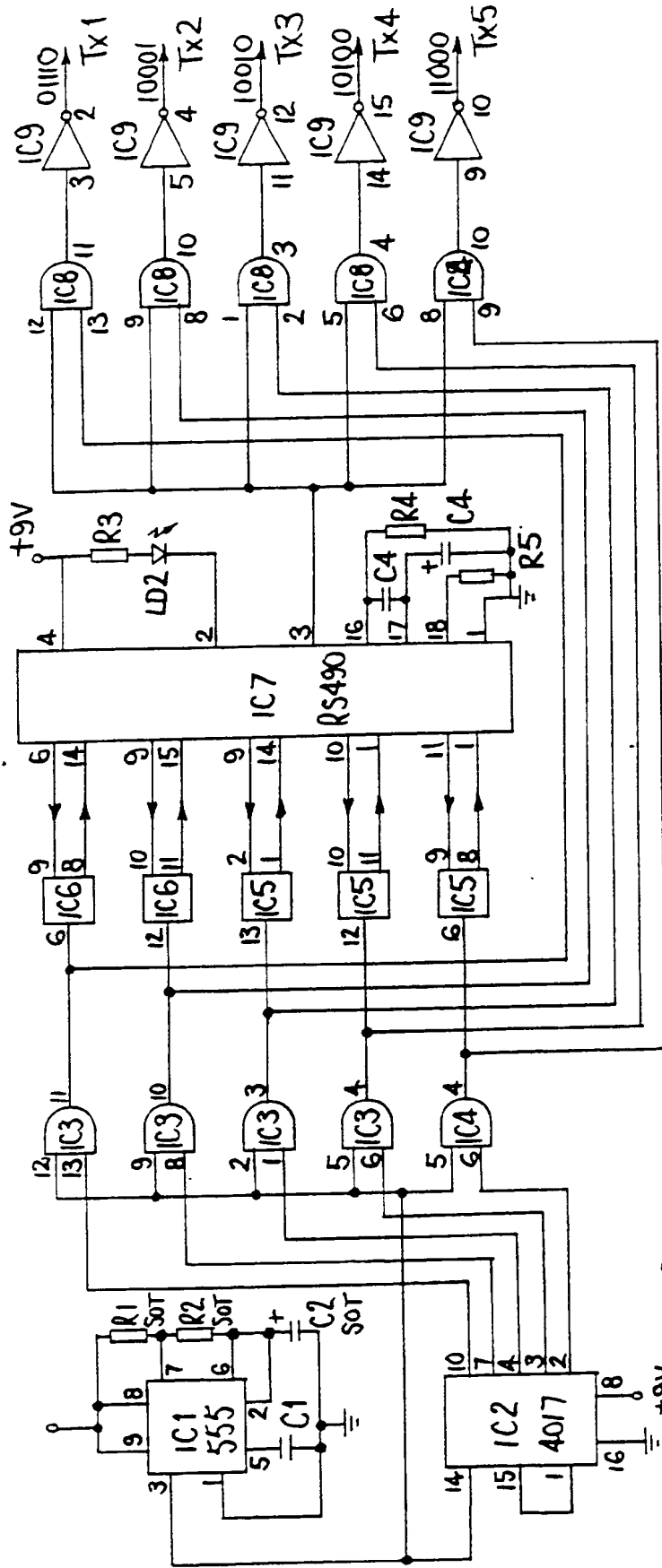
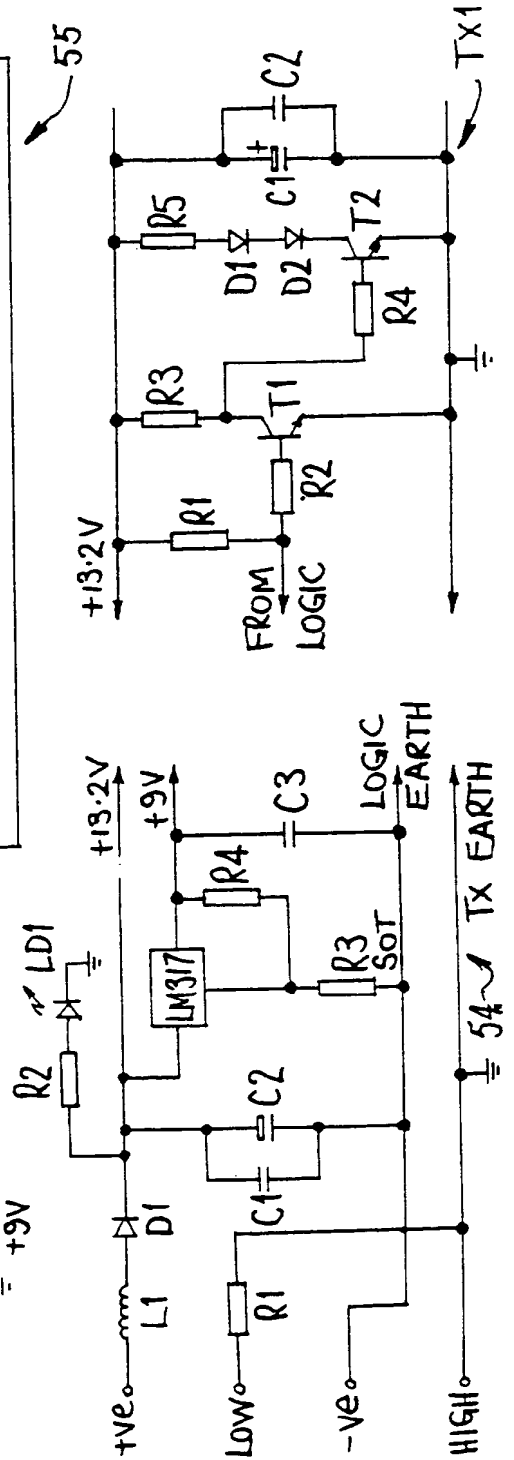


FIG 7



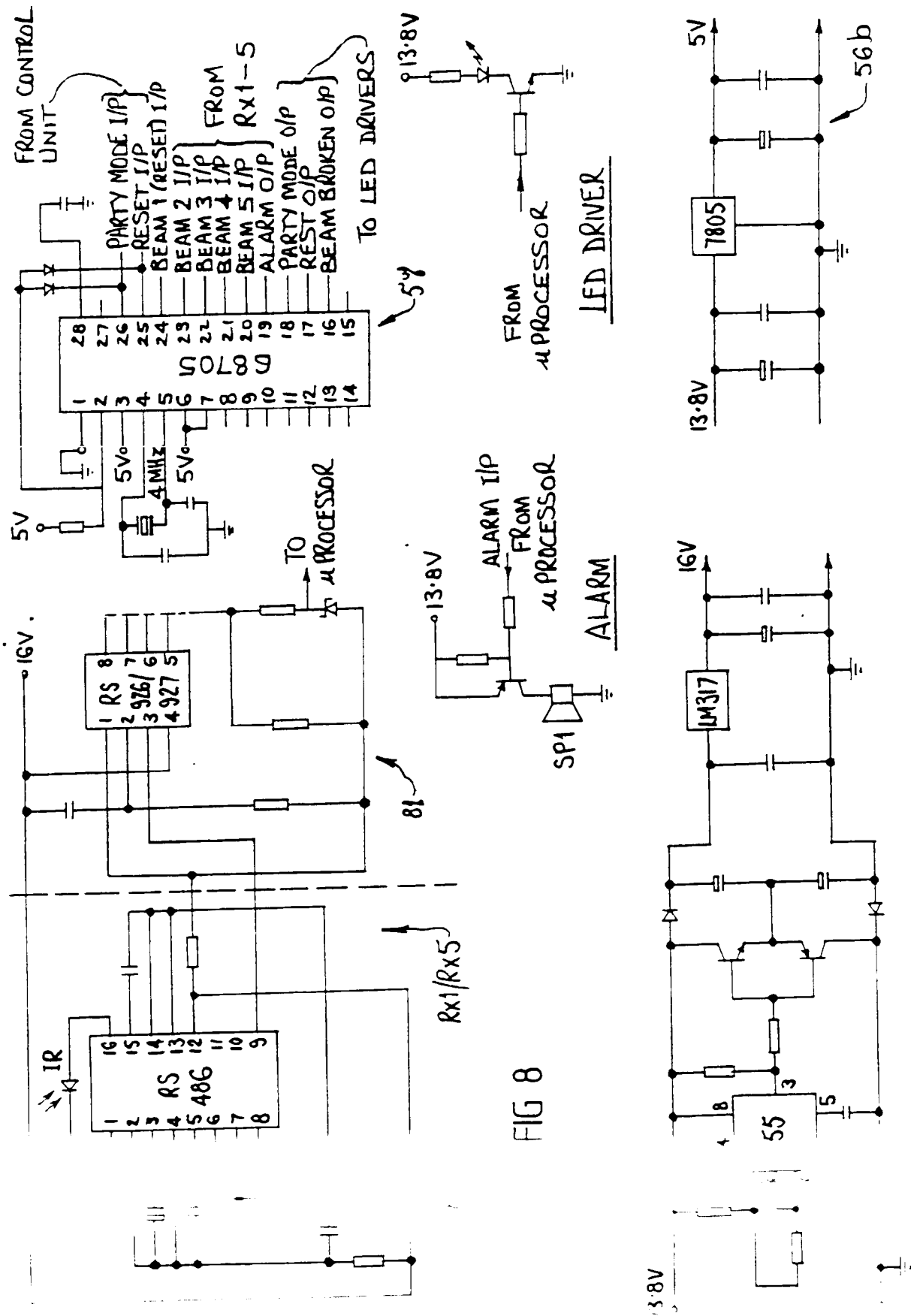


FIG 8

INTERNATIONAL SEARCH REPORT

International Application No PCT/AU 87/00230

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) According to International Patent Classification (IPC) or to both National Classification and IPC <div style="text-align: center; font-size: 1.2em;">Int. Cl.⁴ G08B 13/18</div>																					
II. FIELDS SEARCHED <div style="text-align: center; font-size: 0.8em;">Minimum Documentation Searched⁷</div> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;">Classification System</td> <td style="width: 50%; border: none;">Classification Symbols</td> </tr> <tr> <td style="border: none; text-align: center;">IPC</td> <td style="border: none; text-align: center;">G08B 13/18</td> </tr> </table> <div style="text-align: center; font-size: 0.8em; margin-top: 5px;">Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched⁸</div> <div style="text-align: center; font-size: 1.1em; margin-top: 10px;">AU: IPC as above</div>		Classification System	Classification Symbols	IPC	G08B 13/18																
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Category ¹⁰	<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 15%; border-bottom: 1px solid black;">Citation of Document¹¹ with indication, where appropriate, of the relevant passages¹²</th> <th style="width: 15%; border-bottom: 1px solid black;">Relevant to Claim No.¹³</th> </tr> </thead> <tbody> <tr> <td>X,Y US,A, 3825916 (SEELE et al) 23 July 1974 (23.07.74)</td> <td>(1-5,8,12-15, 17)</td> </tr> <tr> <td>X,Y AU,A, 90310/82 (HUGHES TECHNOLOGY PTY LTD) 19 May 1983 (19.05.83)</td> <td>(1,4,8,12-15, 17)</td> </tr> <tr> <td>X,Y WO,A, 84/04986 (HUGHES TECHNOLOGY PTY LTD) 20 December 1984 (20.12.84)</td> <td>(1,4,8,12,17)</td> </tr> <tr> <td>X,Y GB,A, 1212094 (SHORROCK DEVELOPMENTS LTD) 11 November 1970 (11.11.70)</td> <td>(1,2,4,8,12, 17)</td> </tr> <tr> <td>X,Y DE,A, 2324008 (HANS) 28 November 1974 (28.11.74)</td> <td>(1,2,4,8,12, 17)</td> </tr> <tr> <td>Y GB,A, 1524564 (TELUB AB) 13 September 1978 (13.09.78)</td> <td>(1-5,8,12,13, 17)</td> </tr> <tr> <td>Y CA,A, 1036686 (XENEX CORP) 15 August 1978 (15.08.78)</td> <td>(1-8,12,13,17)</td> </tr> <tr> <td>Y US,A, 3688298 (MILLER et al) 29 August 1972 (29.08.72)</td> <td>(1,8,13-15,17)</td> </tr> <tr> <td>Y US,A, 3898639 (MUNCHERYAN) 5 August 1975 (05.08.75)</td> <td>(1,2,4,8,13-15, 17)</td> </tr> </tbody> </table>	Citation of Document ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³	X,Y US,A, 3825916 (SEELE et al) 23 July 1974 (23.07.74)	(1-5,8,12-15, 17)	X,Y AU,A, 90310/82 (HUGHES TECHNOLOGY PTY LTD) 19 May 1983 (19.05.83)	(1,4,8,12-15, 17)	X,Y WO,A, 84/04986 (HUGHES TECHNOLOGY PTY LTD) 20 December 1984 (20.12.84)	(1,4,8,12,17)	X,Y GB,A, 1212094 (SHORROCK DEVELOPMENTS LTD) 11 November 1970 (11.11.70)	(1,2,4,8,12, 17)	X,Y DE,A, 2324008 (HANS) 28 November 1974 (28.11.74)	(1,2,4,8,12, 17)	Y GB,A, 1524564 (TELUB AB) 13 September 1978 (13.09.78)	(1-5,8,12,13, 17)	Y CA,A, 1036686 (XENEX CORP) 15 August 1978 (15.08.78)	(1-8,12,13,17)	Y US,A, 3688298 (MILLER et al) 29 August 1972 (29.08.72)	(1,8,13-15,17)	Y US,A, 3898639 (MUNCHERYAN) 5 August 1975 (05.08.75)	(1,2,4,8,13-15, 17)
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IV. CERTIFICATION																					
Date of the Actual Completion of the International Search <div style="text-align: center; font-size: 1.1em;">28 September 1987 (28.09.87)</div>	Date of Mailing of this International Search Report <div style="text-align: center; font-size: 1.2em;">(09.10.87) 9 OCTOBER 1987</div>																				
International Searching Authority <div style="text-align: center; font-size: 1.1em;">Australian Patent Office</div>	Signature of Authorized Officer <div style="text-align: center; font-size: 1.2em;">R. Hallett</div> <div style="text-align: right; font-size: 1.1em;">R. HALLETT</div>																				

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON
INTERNATIONAL APPLICATION NO. PCT/AU 87/00230

Patent Document
Cited in Search
Report

Patent Family Members

AU 90310/82

GB 2108743

WO 8404986

AU 30189/84

GB 1524564

CH 592929
SE 7411856

DE 2541846

NL 7511114

CA 1036686

DE 2451100

GB 1482567

US 3970846

END OF ANNEX

